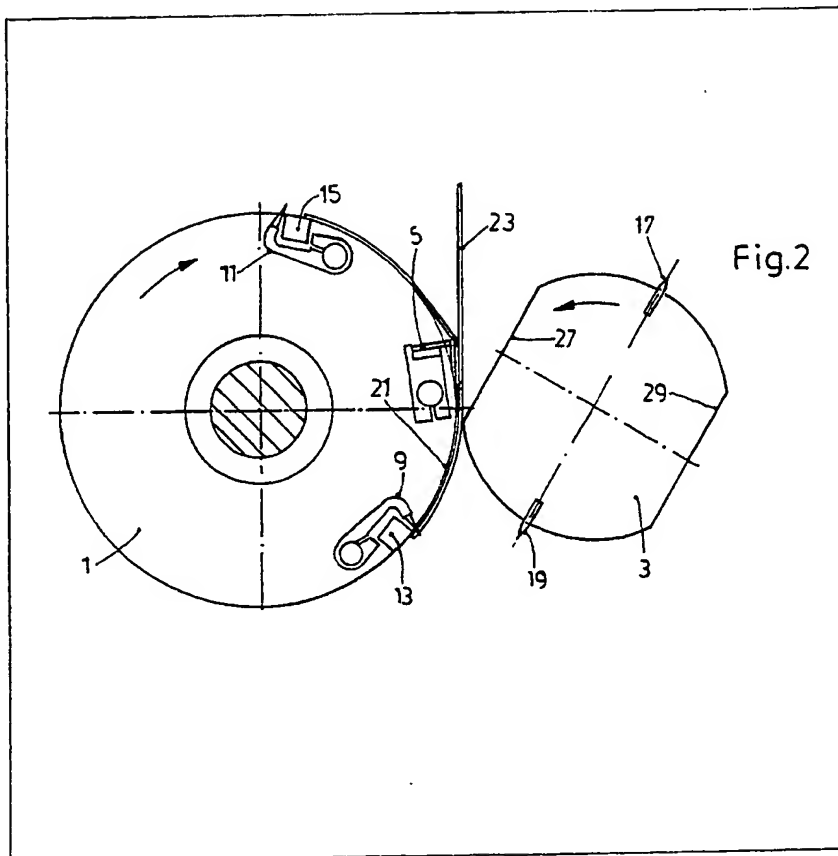


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(54) Cutting and folding sheets

(57) A folding mechanism adapted for cutting printed sheets from a web, includes a collecting cylinder 1 with radially movable folding blades e.g. 5, cutting grooves e.g. 11, 13 and grippers e.g. spikes 9, 11, a cutting cylinder 3 with cutting knives 17, 19, and a receiving cylinder not shown. Two sheets are collected on each gripper and transferred to the receiving cylinder. To avoid the end of the first collected sheet 21 being trimmed a second time when the second, superposed sheet 23 is cut from the web, the folding blade 5 underneath the sheets is moved radially outwards to displace the end of the first sheet away from the cutting groove 15. Contact between a projecting folding blade and the cutting cylinder is avoided by providing flats 27, 29 on the latter or by not moving the blade out until after it has passed the nip.



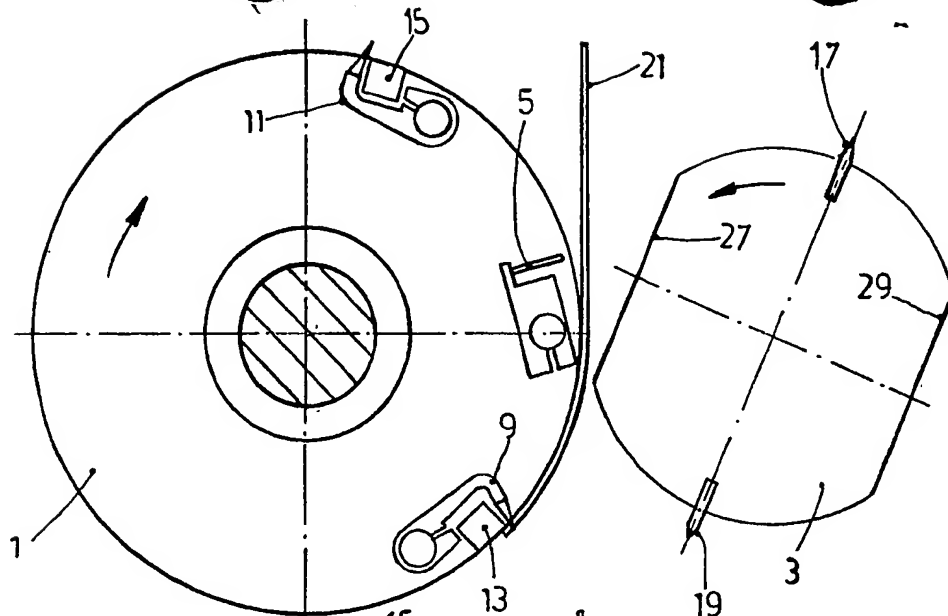


Fig.1

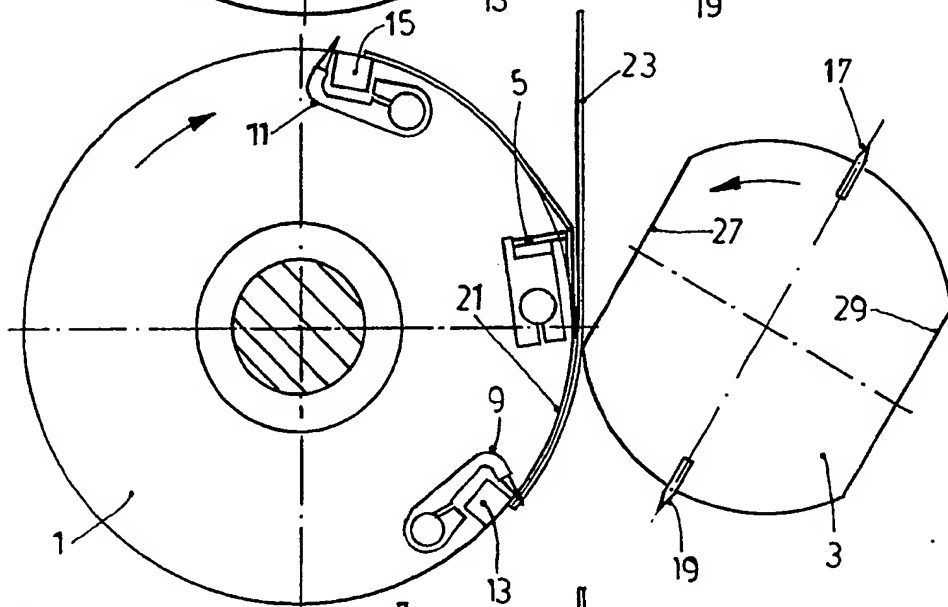


Fig.2

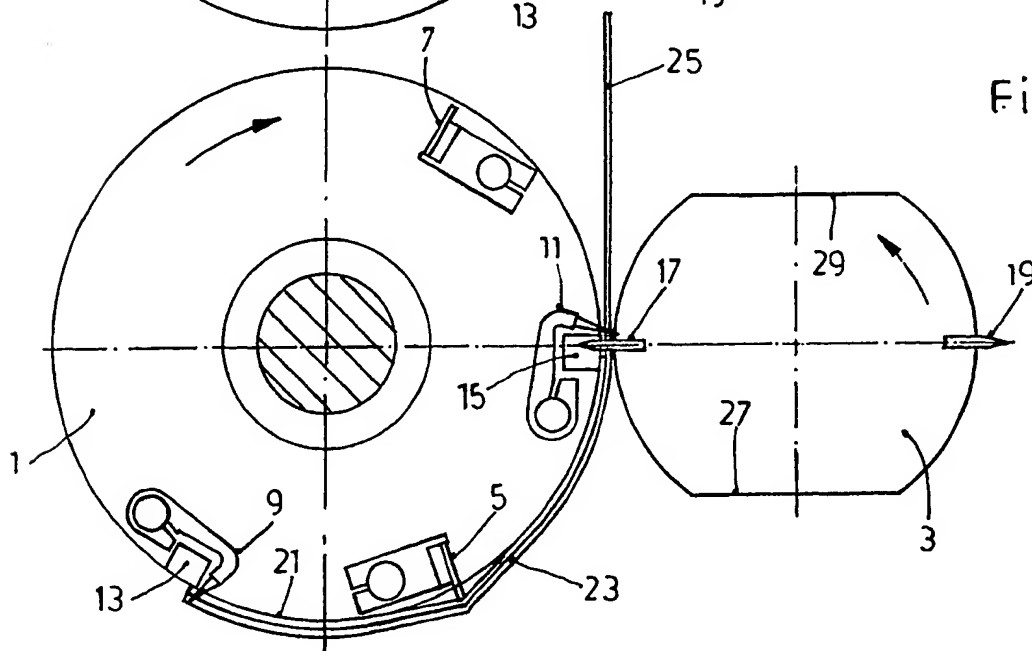


Fig.3

SPECIFICATION

Folding mechanism adapted to cut sheets from a web

This invention relates to a folding mechanism adapted for cutting sheets from a web, which includes a collecting cylinder having at least one gripping means and at least one folding blade cooperable with a receiving cylinder, and a cutting cylinder having at least one cutting member, e.g. a knife, which engages a second cutting member, e.g. a groove, on the perimeter of the collecting cylinder, the folding mechanism being operable so that two cut sheets disposed one on top of the other are collected by the gripping means on the collecting cylinder and are transferred to the receiving cylinder.

In folding mechanisms associated with printing presses, in which two printed sheets are separated in turn from the web by the cutting blade of a cutting cylinder acting directly against a cutting groove on the collecting cylinder a most disruptive feature occurs in the collecting operation, namely that the trailing end of the first sheet already on the collecting cylinder is cut again when the second sheet is trimmed from the web. This can be attributed to the fact that the first sheet already conveyed around the collecting cylinder once, the so-called inset, or deposited sheet, fits more tightly against the cylinder than does the second sheet and, on the other hand, it slips back somewhat on the collecting cylinder owing to the forward sloping position of the spiking pins, constituting the gripping means, in the direction of rotation. Through this second cutting of the first sheet, not only is the paper consumption increased which, given the high operational speed of these type of printing presses, matters a great deal, but also a collection of thin strips of paper is formed which, because of their very small width, are difficult to handle and therefore troublesome to clear away.

Alexander Braun's essay "Folding Unit Systems of Modern Rotary Letterpress And Illustration Machines And Their Method of Operation" in the journal "Der Polygraph" ED. 13, 1954 pp. 742-745 puts forward various possible ways of avoiding a snipping of the first deposited sheet by arranging that the trailing end of that sheet is not conveyed through the cutting position a second time. Thus to obtain a shorter first deposited sheet the spiking pins can be moved with the similarly gripped leading end of the web back in the direction of movement of the collecting cylinder and after the cutting of the second sheet can be moved forward again. This is, however, very expensive to control and, in the case of operating speeds of, for example, over 25,000 cylinder rotations per hour, is also too slow.

Another proposed solution is to deflect the cutting blade so that the first deposited sheet is cut somewhat shorter than the second sheet each time. In this case, however, the cutting groove with its cut-off rubber against which the cutting

knife acts must also be deflected together with the cutting knife since, otherwise, the rubber would break up as a result of the cuts for both printed sheets being positioned so close to one another, and would allow for no further cutting. The synchronous control of the cutting knife and the cutting groove is also very expensive and susceptible to difficulties.

It has also already been suggested that, in the case of the cutting cylinder, two successive cutting blades be shifted towards one another. This method is very simple but has the disadvantage that the stability of the cutting rubber is reduced considerably and the paper consumption is noticeably increased.

Finally, it has also been proposed to deflect both printed sheets to a certain degree by a radial displacement bar shortly before the second sheet is cut so that the first sheet is pulled away only slightly from the cutting blade. In this proposal the displacement bar is situated in the cutting cylinder near to the second cutting blade and functions in conjunction with a groove which is provided in the collecting cylinder near the cutting groove. This displacement bar must be adjusted as to its radial position to suit the various web strengths and this process leads to time-consuming adjustment operations and makes the construction complicated and susceptible to trouble. Moreover, a displacement bar of this type, being disposed in the cutting cylinder, in the case of many products promotes a set off of the print on the displacement bar itself or on the edges of the groove for the displacement bar.

According to the present invention there is provided a folding mechanism adapted for cutting sheets from a web, including a collecting cylinder provided with gripping means, a folding blade and a first cutting member, the folding blade being circumferentially spaced behind the gripping means in the direction of rotation of the collecting cylinder and ahead of the first cutting member, and being movable between a radially inner position and a radially outer position in which the blade projects beyond the periphery of the cylinder, a cutting cylinder having a second cutting member which during the rotation of the cylinders cooperates with the first cutting member to cut a web, and a receiving cylinder having folding means for receiving sheets from the folding blade, the folding mechanism being adapted to collect on the collecting cylinder two sheets disposed one over the other and held by the gripping means and to transfer the two sheets to the receiving cylinder, means being provided for displacing the folding blade to its radially outer position after the first of two sheets has been cut from a web and before the superposed second sheet is cut off from the web.

Preferably, the first cutting member is a cutting groove and the second cutting member is a cutting knife.

The collecting cylinder may be provided with a plurality of the gripping means, a plurality of folding blades and a plurality of cutting grooves, each folding blade being located at a position equally circumferentially spaced from a gripping means ahead of it and a cutting groove behind it.

A folding mechanism in accordance with the

invention does not require any additional parts for avoiding the second cutting of the first sheet. Only the displacing means, e.g. a cam, necessary in any case for actuating the or each folding blade needs to be altered so that the or each folding blade is moved radially outwards beyond the periphery of the collecting cylinder not only in the area of the receiving cylinder but also in its passage passed the cutting cylinder. This can take place at the same operational speed and with the same reliability as the folding itself. This cam does not need to be adjusted to suit different web strengths. The folding mechanism has the further advantage that between the folding blade and the product no relative motion takes place so that there is no risk of set-off of the print.

In one embodiment of the invention, the cutting cylinder has one or more flats on the peripheral surface, the cutting cylinder being coordinated with the collecting cylinder so that the or each flat moves around opposite the or a radially outwardly positioned folding blade of the collecting cylinder so that the bulge in the paper over the folding blade can pass through between the collecting cylinder and the cutting cylinder without any trouble.

In another embodiment of the invention, the or each folding blade of the collecting cylinder cannot be moved beyond the periphery of the collecting cylinder until after the folding blade has passed the point of contact, or nip, between the collecting cylinder and the cutting cylinder. This means that the bulge in the paper does not occur until the folding blade has passed by the cutting cylinder.

The invention may be put into practice in a number of ways but one specific embodiment will now be described by way of example with reference to the accompanying drawing, in which:-

Figure 1 shows a folding mechanism in accordance with the invention with a first printed sheet pierced by the spiking pins of a gripper means;

Figure 2 shows the folding mechanism shown in *Figure 1*, with two printed sheets placed one on top of the other before the second printed sheet is cut from the web; and

Figure 3 shows the same mechanism after the second printed sheet has been cut off from the web.

The drawing shows a combined cutting groove-, folding blade- and collecting cylinder 1 (referred to hereinafter as the collecting cylinder) and a cutting cylinder 3 the diameters of which in this embodiment are in the ratio of 3:2. The collecting cylinder 1 carries three movable folding blades, three rows of movable spiking pins acting as gripper means, and three cutting grooves arranged respectively closely adjacent the rows of spiking pins; the folding blades, on the one hand, and the closely adjacent rows of spiking pins and cutting grooves, on the other hand, are arranged at equal distances from one another on the periphery of the collecting cylinder 1. In the *Figures* only two folding blades 5 and 7, two rows of spiking pins 9 and 11 and two cutting grooves 13 and 15 are shown. The cutting cylinder 3 has two cutting knives 17 and 19 corresponding to the diameter ratio mentioned, which act in conjunction with the cutting grooves 13, 15 of the collecting cylinder 1.

The folding mechanism functions so that the individual printed sheets are pierced, and thereby gripped, one after the other by the spiking pins, are each separated from the web by a cut made by the interaction of one of the cutting knives and its cutting groove, and are conveyed around the collecting cylinder 1. In the non-collecting operation the mid portion of each printed sheet is pushed out just after passing the cutting cylinder 3 by a folding blade which is moved radially outwards beyond the periphery of the collecting cylinder 1 to put the sheet into the folding jaws of a receiving cylinder not illustrated here. In the collecting operation this only happens with every second folding blade, when two printed sheets are collected one on top of the other.

As a rule, if no measures are taken to prevent it, when the second of two printed sheets placed on top of one another is cut off from the web the trailing end of the first printed sheet is trimmed a second time. This produces a very thin undesirable shred of paper which is difficult to remove. Such a second trimming of the first printed sheet can be prevented in a very simple manner through the steps described in the following paragraphs.

Figure 1 shows how a first printed sheet 21 is picked up by the row of spiking pins 9. When the cylinders 1 and 3 continue to rotate in the direction of the arrows marked, the printed sheet 21 is separated from the web at its trailing end by interaction of the cutting knife 17 and the cut-off rubber of the cutting groove 15. In the collecting operation the printed sheet 21 is then conveyed right round the collecting cylinder 1 until it arrives at the position shown in *Figure 2*.

At this stage the row of spiking pins 9 has already pierced the leading end of a second printed sheet 23, this sheet being the one which had occupied the fourth position in the web, counting with sheet 21 as occupying the first position, since the second and third sheets consecutively arranged on the web will have been taken up respectively by the row of spiking pins 11 and the third row (not shown) to become the first deposited sheets collected by those gripping means. In order now to pull the printed sheet 21 away from the cutting groove 15 a little, the folding blade 5 located in the middle of the printed sheet 21 is displaced radially outwards beyond the periphery of the collecting cylinder 1, thus forming a bulge which takes up part of the printed sheet 21 and moves its trailing end away from the cutting groove 15.

The folding blade 5 remains in its radially outer position until the printed sheet 23 is separated off from the web by the interaction of the cutting knife 17 and the cutting groove 15, as shown in *Figure 3*. In this cutting of the second sheet the printed sheet 21 underneath no longer has its trailing end trimmed by the cutting blade 17.

Another printed sheet 25 is subsequently picked up by the row of spiking pins 11 and is conveyed right round the collecting cylinder 1 as the first of two printed sheets to be placed one on top of the other, whilst the two printed sheets 21 and 23 are delivered to the folding jaws of the receiving cylinder by the folding blade 5.

On opposite sides of the cutting cylinder 3, midway between each of its two cutting knives 17 and 19, is a flat 27, 29, so that the bulge in the paper shown in Figure 2 can pass through unhindered between the collecting cylinder 1 and the cutting cylinder 3. However, as an alternative to providing the flats 27, 29, it is possible not to commence the displacement of the folding blade until after it has already passed the "nip" between the collecting cylinder and the cutting cylinder 3. The cutting cylinder 3 does not then require flats.

The folding mechanism in accordance with the invention requires no additional parts to obtain the short and long cuts described above. Only the folding blade displacement means must be suitably constructed. The paper consumption is determined by the amount of radial displacement of the folding blade and, as the displacement of the ends of the first deposited printed sheets can be kept quite small because the amount of displacement necessary to avoid second trimming can be determined accurately owing to the fact that the cutting knife cuts into the same groove over and over again, the paper wastage is also only very low.

25 CLAIMS

1. A folding mechanism adapted for cutting sheets from a web, including a collecting cylinder provided with gripping means, a folding blade and a first cutting member, the folding blade being circumferentially spaced behind the gripping means in the direction of rotation of the collecting cylinder and ahead of the first cutting member, and being movable between a radially inner position and a radially outer position in which the blade projects beyond the periphery of the cylinder, a cutting cylinder having a second cutting member which during rotation of the cylinders cooperates with the first cutting member to cut a web, and a receiving cylinder having folding means for receiving sheets from the folding blade, the folding mechanism being adapted to collect on the collecting cylinder two sheets disposed one over the other and held by the gripping means and to transfer the two sheets to the receiving cylinder, means being provided for displacing the folding blade to its radially outer position after the first of two sheets has been cut from a web and before the superposed second sheets is cut off from the web.

2. A folding mechanism as claimed in claim 1, in which the first cutting member is a cutting groove and the second cutting member is a cutting knife.

3. A folding mechanism as claimed in claim 2, in which the collecting cylinder is provided with a plurality of the gripping means, a plurality of folding blades and a plurality of cutting grooves, each folding blade being located at a position equally circumferentially spaced from a gripping means ahead of it and a cutting groove behind it.

4. A folding mechanism as claimed in claim 3, in which each gripping means is arranged closely adjacent a respective one of the cutting grooves.

5. A folding mechanism as claimed in claim 4, in which there are three folding blades equally spaced

from each other around the collecting cylinder, and three sets of closely adjacent gripping means and cutting grooves.

6. A folding mechanism as claimed in any one of claims 2 to 5, in which the cutting cylinder has a plurality of cutting knives.

7. A folding mechanism as claimed in any one of the preceding claims, in which the cutting cylinder has one or more flats on its peripheral surface, the cutting cylinder being coordinated with the collecting cylinder so that the or each flat moves around opposite the or a radially outwardly positioned folding blade of the collecting cylinder whereby the folding blade does not contact the cutting cylinder surface.

8. A folding mechanism as claimed in any one of claims 1 to 6, in which the means for displacing the or each folding blade to its radially outer position before the superposed second sheet is cut off from the web, is arranged so that the or each folding blade does not so move to its radially outer position until after the collecting cylinder has rotated to carry the folding blade passed the nip between the collecting and cutting cylinders.

9. A folding mechanism as claimed in any one of the preceding claims, in which the or each gripping means comprises a set of spiking pins.

10. A folding mechanism substantially as specifically described herein with reference to the accompanying drawing.